

MY CONCEPT OF THE BEETLE FAMILY CONONOTIDAE
CROWSON = ANTHICIDAE (COLEOPTERA)—A NEW
INTERPRETATION OF THE OLD OBSERVATIONS

MOHAMMAD ABDULLAH^{1,2,3}

ABSTRACT*

Earlier authorities placed the heteromerous beetle genera *Lagrioida* Fairm. & Germ., *Cononotus* LeConte, and *Agnathus* Germar in Pythidae, Salpingidae, Lagriidae, Melandryidae, and Cononotidae and interpreted their similarities to Anthicidae as a result of convergence. They are undoubtedly anthicids, and Cononotidae Crowson (1953) is a junior synonym of Anthicidae Latreille (1825) (**syn. n.**). *Lagrioida* (as well as the other 2 genera) have the metacoxae widely separated (as in Anthicinae) and differ from all Eurygeniinae in this character as well as in having the first 2 visible abdominal sternites connate (unlike other subfamilies) and is therefore removed from Eurygeniinae, and placed in a **new subfamily, Lagrioidinae Abdullah**—a derivative group more or less intermediate between Eurygeniinae and Anthicinae. The known primitive and derivative characters are given along with a key to the world subfamilies of Anthicidae, and tribes (Lagrioidini, Agnathini, and Cononotini), genera and species of Lagrioidinae. A catalogue of Lagrioidinae (Anthicidae) is also given. I urge that a restriction or ban on descriptions of new species, proposed by several authorities, should be extended to the descriptions of new families in Coleoptera and other groups.

INTRODUCTION

I had earlier treated the cicindelid beetles in a subfamily of Carabidae (Abdullah, 1969) following others but have later given them a distinct family (Cicindelidae) status (Abdullah, in press) before Mandl's (1971) work was published and on my own assessment. On the other hand, in this work I shall be suppressing a family of Heteromera (Cucujoidea) and shall give my reasons for doing so. My concept of Heteromera is presented in earlier papers (Abdullah, 1964, 1969, in press, and Abdullah & Abdullah, 1966). The group Heteromera is monophyletic, distinguished primarily by the evolution of the heteromeroid aedeagus in the male which is an important phylogenetic character. To determine whether a certain cucujoid beetle is a member of Clavicornia or Heteromera check the aedeagus. If it is of the heteromeroid type (evolved from the cucujoid type by the loss of the ventral part of the ring-piece of the tegmen, leaving the lateral lobes or parameres attached to a dorsal basal-piece—analogueous to the trilobe type of tegmen of the Dasilloidea, etc., but with the tegmen dorsal and median lobe ventral in orientation) or derivable from it (such as the tegmen lateral or even ventral as in

¹Senior Postdoctoral Fellow of the Alexander von Humboldt Foundation in West Germany, when this was written.

²Thanks are due to the Director, Dr. Walter Forster for space and research facilities, and Dr. Heinz Freude for the specimens of *Agnathus decoratus*.

³Current address: 146 Sherwood St., Nottingham, England NG 1 4EF.

*For a German translation of the abstract, see last page.

the Anthicidae, Monommidae, Zopheridae, etc.) then it is Heteromera. The Heteromera have evolved certain other characters: heteromeroid tarsi, trochanters, etc., but they do not all develop at the same time and are subject to secondary modifications (Abdullah, in press). It is possible to find a primitive group of Heteromera where the aedeagus is heteromeroid, and other features are still clavicorn. A phenetic classification based on "totality of their structure" (Crowson, 1967:106) will lead to false or unscientific conclusions.

A well-known example is the fossil bird, *Archaeopteryx*. Mayr (1963:596) wrote, "*Archaeopteryx*, the 'missing link' between reptiles and birds, is a typical pseudosuchian reptile in nearly all of its characters, but in its feathers it is like a modern bird." There are more reptilian (ancestral) characters: 1) teeth, 2) free tail vertebrae (20), 3) ribs simple, without processus uncinati, 4) brain simple, with small cerebellum, 5) metacarpals free, 6) metatarsals free, 7) ilia and ischia separated. While the avian (derivative) characters are even less: 1) feathers, 2) furcula, 3) pelvis with backward pubes, 4) large eyes (Heberer, 1957). Those taxonomists who classify organisms on the "totality of their structure" (Crowson, 1967:106) will regard this primitive bird a member of Reptilia, while a phylogenetic systematist will not. Furthermore, "One of the oldest known amphibians, the stegocephalian *Ichthyostega* from the upper Devonian of Greenland, has as many (or more) fish characters as amphibian characters (Heberer, 1957:874; Jarvik, 1955)" (Mayr, 1963:596).

Systematic Position of Cononotidae

Crowson (1953:41,52) proposed the family name Cononotidae in the Heteromera, for the following 3 genera of Cucujoidea: *Cononotus* LeConte, 1851 from U.S.A., *Agnathus* Germar, 1825 from central Europe, and possibly *Lagrioida* Fairmaire & Germar, 1860 from Tasmania, New Zealand, and Chile. This brought them together for the first time within a family. Earlier authorities included *Cononotus* and *Lagrioida* in Pythidae or Melandryidae; for instance, *Cononotus* in the Pythidae by Hatch (1965), and in the Salpingidae by Arnett (1968), etc. Kaszab (1969) recently incorrectly treated *Agnathus* in Lagriidae, although he is correct when he writes, "Die Körperform erinnert an Anthiciden." Crowson (1953:52) also stated "The affinities of the family [Cononotidae] seem to be to Salpingidae and Mycteridae on one hand and to the Anthicid group on the other." On the one hand he is right and on the other wrong. The observations of the older authorities are correct but their interpretations are incorrect because when they place these genera in Lagriidae (or any other family) they interpret the similarities of the 3 genera to that group due to true (phylogenetic) relationships while attributing their similarities with Anthicidae to convergence. This is an error of judgment, or lack of theoretical ability to deduce phylogenetic relationship from the observed data, common among many practicing taxonomists which I want to emphasize. Crowson (1969:453) is critical of all "systematic workers" (not only D. G. Kissinger) who are capable of recognising 'specific', 'generic' and 'tribal' characters within a family as a result of their intensive study of a family (which among modern coleopterists includes almost everyone except Crowson) and who "When describing a series of taxa of the same rank, they try to refer every time to the same characters in the same order and with the same forms of words, and to provide strictly comparable illustrations for each of the taxa" . . . "Their systems are always presented as something complete,

coherent and closed; they do not draw attention to deficiencies in human knowledge, make predictions or suggest problems for future research." Unfortunately, those who think their system and mind is open rather than closed do not always make the best use of it, their practice is not always consistent with their theory, their judgment of those who differ from them at times reflects ignorance or deep-rooted prejudice of one kind or another rather than science.

Lagrioida species are typical anthicid beetles (although Champion, 1890 placed them in Melandryidae) but have the first 2 visible sternites connate which is a derivative feature for Anthicidae (sensu lato). The genus was placed in a separate tribe (Lagrioidini) in the subfamily Eurygeniinae of the Anthicidae (Abdullah & Abdullah, 1968). But now I give it subfamily status, since, unlike Eurygeniinae, the metacoxae are widely separated as in Anthicinae. The larva of the American *Pergetus campanulatus* of the tribe Eurygeniini is known, that of *Lagrioida* is not expected to be completely similar since the 2 genera (now placed in different subfamilies) were still placed in different tribes earlier. My studies of Heteromera have revealed that Anthicidae could have evolved from Pyrochroidae, Pyrochroidae from Pythidae, and Meloidae from Anthicidae (Abdullah, 1969). I do not think that Oedemeridae and Anthicidae could have evolved from each other, and no modern authority on Oedemeridae has reached this conclusion. However, Crowson (1967:135) wrote, ". . . the genus *Lagrioida* (s. temperate regions) appears to link the present family [Oedemeridae] with Cononotidae and Anthicidae." 'Predictions' and 'hypotheses' that 'appear' and 'disappear,' to workers such as this, should not be taken seriously unless they are based on sound judgment of scientific observations.

With the earlier transfer of *Lagrioida* to Anthicidae (in the subfamily Lagrioidinae) the Cononotidae of Crowson (1953) is now left with 2 genera: *Cononotus* and *Agnathus*. I have decided to place them together within a family on the basis of Crowson's (1953:52) statement . . . "The two genera seem to agree in all essential points of adult structure." I had earlier attached more importance to the character of the middle coxal cavity (following Crowson, 1953) as to whether it is **open** by reaching the epimera or **closed** by the sterna when I recognized Cononotidae of Crowson as a family distinct from Anthicidae (Abdullah, 1964 & 1969); otherwise they are similar. In fact, *Lagrioida*, which was placed by Crowson (1953:52) in his Cononotidae, has open mesocoxal cavities while the other 2 genera have them closed according to Crowson (which is not true!). Does Crowson believe it is phylogenetically feasible to have the 2 conditions within the same family? I have not checked the middle coxal cavities in all the genera of Anthicidae and will not be surprised if some genera of Anthicidae and will not be surprised if some genera have them apparently closed or nearly so, secondarily. Under the circumstances, I am prepared to accept the opening or near closure of the middle coxal cavities a polyphyletic and variable character. *Cononotus* and *Agnathus* are also transferred to the Anthicidae (s.l.) and Cononotidae becomes a junior synonym of Anthicidae (Latreille, 1825).

Characters of Lagrioidinae Abdullah, new subfamily

Within the Anthicidae, *Cononotus* and *Agnathus* cannot be placed in any of the earlier recognized subfamilies. They differ from Pedilinae and

Steropinae in having internally closed front coxal cavities (Crowson, 1953:40, couplet 13), although Arnett (1968:714) stated, "Procoxal cavities open behind"—probably meaning only visibly open in *Cononotus*; from Pedilinae, Steropinae, Macratriinae, Copobaeninae and Eurygeniinae in having widely separated metacoxae (Arnett, 1968:716 and Hatch, 1965:84, including my own observations on *Agnathus decoratus*); from Steropinae and Anthicinae in having a wide or broad neck; from Pedilinae, Steropinae, Macratriinae, and some Anthicinae in having the parameres or lateral lobes of the tegmen fused throughout (Crowson, 1953:42, Fig. 143); and from Macratriinae in having the internal keel of hind coxa reduced to a narrow-based apophysis (Crowson, 1953:46, Fig. 152). I therefore place these genera in the new subfamily Lagrioidinae, with the first 2 visible abdominal sternites connate as a distinguishing feature.

In my opinion the following are the **primitive characters** of the Lagrioidinae: neck wide (as in Pedilinae, Copobaeninae, Eurygeniinae, and ancestral families Pyrochroidae and Pythidae, etc.); mes-episterna meeting or nearly so in front of mesosternum (as in most anthicids except *Macratria* and *Loubacantus*); and internal keel of hind coxa reduced to a narrow-based apophysis (as in all known anthicids except *Macratria*).

The following are the **derivative distinguishing characters** of Lagrioidinae: apical segment of maxillary palp securiform (as in *Loubacantus* etc.); meso-coxal cavities nearly open; hind coxae widely separated by a broad process of the first visible abdominal sternite (as in Anthicinae); aedeagus with the lateral lobes or parameres fused throughout (as in Eurygeniinae or Copobaeninae etc.); and first 2 visible abdominal sternites connate (unlike any other known subfamilies). The subfamily Lagrioidinae is in certain respects intermediate between Eurygeniinae and Anthicinae, and is a derivative group on the whole.

Tribes of Lagrioidinae

Within the Lagrioidinae, it is possible to distinguish 3 tribes: 1) Lagrioidini for the winged *Lagrioida*, now removed from the Eurygeniinae, with the penultimate segment of the tarsi furnished with a long lobe on each side, these lobes only united at the base (Champion, 1890:122); 2) Cononotini for *Cononotus*, a derivative wingless group, adapted for dry life; and 3) Agnathini for *Agnathus*, a primitive winged group, adapted for life under bark. In the last 2 tribes the penultimate segments of the tarsi are not evidently bilobed. All the tribes have the first 2 visible abdominal sternites connate (unlike any other subfamily) and metacoxae widely separated (as in Anthicinae and unlike Eurygeniinae). When I noticed that *Lagrioida* is also reported to have the hind coxae widely separated as in Anthicinae (Champion, 1890:121), then I immediately recognized that the 3 genera belong to the same subfamily and cannot be placed in Eurygeniinae or any other known subfamily.

After this work was completed, Dr. Heinz Freude showed me 4 specimens of *Agnathus decoratus*, and we checked the middle coxal cavities. They are *definitely open* (as in other Anthicidae), although the meso- and meta-sterna come close together and the mes-epimera reach the meso-coxal cavities. Not only his interpretations but Crowson's observations are sometimes incorrect. The meso-coxal cavities are clearly open in other subfamilies and nearly open in Lagrioidinae but they are not closed. Within the Anthicidae, the connation

of abdominal sternites forms a derivative monophyletic group (Lagrioidinae), although this character also has evolved polyphyletically elsewhere in the order Coleoptera.

Ban on New Families in Coleoptera

Crowson (1970:296) predicts that "The description of new species will inevitably form a continually decreasing proportion of the activity of systematists", and I hope that this will also apply to the description of new families in Coleoptera. If Oldroyd (1966:260) knew the practice of some authorities in my group, surely he would have made the plea for a ban on new families as well as new species: "It should be emphasised that the suggested ban would be on the description and naming on new species only. No one would be thereby prevented from studying species as much as he liked, making keys to them, studying their biology, life histories, early stages. Work done on clearing up known species, bringing them together into a synopsis, is infinitely more valuable than publishing the names of another dozen new species".

A KEY TO THE WORLD SUBFAMILIES OF ANTHICIDAE (Abdullah, 1969)

- | | | |
|--------|--|----------------------------------|
| 1. | Hind coxae contiguous and not separated by a distance more than the length of coxa | 2 |
| 1'. | Hind coxae widely separated by a distance more than the length of coxa | 6 |
| 2(1). | Neck narrow (width much less than half of head across tempora) | 3 |
| 2'. | Neck wide (width more than half that of head across tempora) | 4 |
| 3(2). | Front coxal cavity open visibly and internally; internal keel of hind coxa reduced to a narrow-based apophysis | Steropinae |
| 3'. | Front coxal cavity internally closed; internal keel of hind coxa long and simple | Macratriinae |
| 4(2'). | Front coxal cavity open visibly and internally; aedeagus with the lateral lobes separate at apex | Pedilinae |
| 4'. | Front coxal cavity internally closed; aedeagus with the lateral lobes fused throughout | 5 |
| 5(4'). | Pronotum rufous and not apically flanged; tarsal claws basally toothed or simple; ovipositor with 2-segmented coxites.. | Copobaeninae |
| 5'. | Pronotum not rufous and apically flanged, if not flanged then galea palp-like; ovipositor usually without completely 2-segmented coxites | Eurygeniinae |
| 6(1'). | Neck wide; middle coxal cavities nearly open; first 2 visible abdominal sternites connate | Lagrioidinae Subfam. nov. |
| 6'. | Neck narrow; middle coxal cavities clearly open; all abdominal sternites free | Anthicinae |

A key to the world tribes, genera, and species of Lagrioidinae
(Van Dyke, 1939 for *Cononotus*; offered tentatively)

1. Winged, penultimate tarsi almost simple (Europe)
..... *Agnathini*; *Agnathus* Germar; *A. decoratus* (Germar)
- 1'. Winged, penultimate tarsi bilobed (New Zealand, Chili, Tasmania) *Lagrioidini*; *Lagrioida* Fairm. et Germ.
a) *L. australis* Champion (Tasmania; antennae short)
b) *L. brouni* Pascoe (New Zealand; antennae long, punctures coarse)
c) *L. obscurella* Fairm. & Germ. (Chili; antennae long)
- 1''. Wingless, penultimate tarsi almost simple (U.S.A.)..... *Cononotini*; *Cononotus* LeConte 2
2. Punctures on elytra fine, dense, and irregular; 2.75-4.25 mm 3
- 2'. Punctures on elytra coarse and in regular rows..... 5
- 3(2). Pubescence fine, sparse, not hiding surface sculpture below; pronotum as wide in front as long 4
- 3'. Pubescence dense, more or less hiding surface sculpture below; pronotum narrower in front than long; elytra elongate, elliptical, nearly 2.5 times as long as broad; 4 mm (S. Arizona)
..... *C. bryanti* Van Dyke
- 4(3). Head finely, sparsely punctate; antennal segments VII-X transverse; pronotum widest one-fourth distance from apex; elytra elliptical, twice as long as broad, somewhat dull and with punctures moderately coarse and close in front and very fine behind; 2.75-3.25 mm (S. California) *C. sericans* LeConte
- 4'. Head coarsely, densely punctate; antennal segments all as long as, or longer than broad; pronotum broadest close to apex; elytra elongate elliptical, over twice as long as broad, somewhat shining and with punctures fine and sparse in front and very minute behind; 4.25 mm (Idaho) *C. lanchesteri* Van Dyke
- 5(2'). Pubescence fine, sparse, not covering surface sculpture below 6
- 5'. Pubescence dense; elytra elliptical, striae not impressed; 3 mm (Owen's Valley, California) *C. macer* Horn
- 6(5). Dark; elytral striae clearly impressed, elytra slightly broader anteriorly; 2.5-3 mm (Los Angeles, California)
..... *C. substriatus* Van Dyke
- 6'. Testaceous, coloured; elytral striae not clearly impressed, elytra elliptical; 1.75-2 mm (Santa Clara & Alameda counties, California) *C. punctatus* LeConte

World Catalogue of Lagrioidinae

Fam. Anthicidae Latreille, 1825

Cononotidae Crowson, 1953, Ent. Mon. Mag. 89:52

(New Synonymy)

Lagrioidinae Abdullah

Lagrioidini Abdullah & Abdullah, 1968, Ent. Mon. Mag. 104:73.

Batobiini (Lacconotinae-Pythidae), partim, Blair, 1928, Col. Cat. 99:29.

Melandyridae (partim), Champion, 1890, Ent. Mon. Mag. (2)1:121; 1895, Trans. Ent. Soc. London:238.

Lagriidae (partim) auctorum.

Pythidae (partim) auctorum.

Salpingidae (partim) auctorum.

Cononotidae auctorum.

TRIBE LAGRIOIDINI

Genus *Lagrioida* Fairm. & Germ., 1860

Lagrioida Fairm. et Germ., 1860, Col. Chili:3; 1863, Ann. Soc. Ent. France (4)III:234; Champion, 1890, Ent. Mon. Mag. (2)1:121; 1916, Ent. Mon. Mag. (3)II:102; Seidlitz, 1917, Mon.:89(1153); Crowson, 1953, Ent. Mon. Mag. 89:52; Abdullah & Abdullah, 1968, Ent. Mon. Mag. 104:73 (in Anthicidae, tribe Lagrioidini).

L. australis Champion, 1895, Trans. Ent. Soc. London:238. **Tasmania.**

L. brouni Pascoe, 1876, Ann. Mag. Nat. Hist. (4) XVIII:58. **New Zealand.**

L. obscurella Fairm. & Germ., 1860, Col. Chili:4; 1863, Ann. Soc. Ent. France (4) III:235. **Chili.**

L. rufula Fairm. & Germ., 1860, Col. Chili:4; 1863, Ann. Soc. Ent. France (4)III:235; Champion, 1895, Trans. Ent. Soc. London:238 (synonymy). **Chili.**

TRIBE CONONOTINI

Cononotini LeConte, 1862, Class. Col. N. America I:254; LeConte & Horn, 1883, Class. Col. N. America II:403; Seidlitz, 1917, Mon.:87(1151).

Cononotinae Blair, 1928, Col. Cat. 99:28.

Cononotidae Crowson, 1953, Ent. Mon. Mag. 89:52 (41 key).

Genus *Cononotus* LeConte, 1851

Cononotus LeConte, 1851, Ann. Lyc. New York 5:137; Lacordaire, 1859, Gen. Col. 5:434; Horn, 1868, Trans. Amer. Ent. Soc. 2:136; Blair, 1928, Col. Cat. 99:28; Crowson, 1953, Ent. Mon. Mag. 89:52.

C. bryanti Van Dyke, 1939, Pan-Pac. Ent. 15:18. **Arizona.**

C. lanchesteri Van Dyke, 1939, Pan-Pac. Ent. 15:19; Hatch, 1965, Beetles Pac. Northwest 4:87. **Idaho, Utah.**

C. macer Horn, 1868, Trans. Amer. Ent. Soc. 2:136; Seidlitz, 1917, Mon.:87(1151); Van Dyke, 1939, Pan-Pac. Ent. 15:20. **California.**

C. punctatus LeConte, 1851, Ann. Lyc. New York 5:138; Seidlitz, 1917, Mon.:87(1151). Van Dyke, 1939, Pan-Pac. Ent. 15:20. **California.**

- C. sericans* LeConte, 1851, Ann. Lyc. New York 5:137; 1857, Ent. Report:51, Pl. 2, Fig. 3; Lacordaire, Gen. Col. Atlas:Pl. 57, Fig. 2; Seidlitz, 1917, Mon.:87(1151). Van Dyke, 1939, Pan-Pac. Ent. 15:20. **California.**
- C. substriatus* Van Dyke, 1928, Bull. Brooklyn Ent. Soc. 23:258; Van Dyke, 1939, Pan-Pac. Ent. 15:20 (? *striatus*). **California.**

TRIBE AGNATHINI

Genus *Agnathus* Germar, 1825

- Agnathus* Germar, 1825, Fn. Ins. Eur., Fasc. 12:Pl. 4; Crowson, 1953, Ent. Mon. Mag. 89:52; Kaszab, 1969 in Freude, Harde, & Lohse, Die Käf. Mitteleur. 8:215.
- Notoxus* (partim), Germar, 1818, Magaz. d. Entom. III:232 ("Megerle v. Mühlfed hat einen diesem entweder sehr ähnlichen, oder vielleicht gar denselben Käfer *Agnathus ornatus* genannt" for *Notoxus decoratus* Germar, but I have not yet found Mühlfed's [or Mühlfeld's] publication!)
- A. decoratus* (Germar) 1818, Magaz. d. Entom. III:229 (in *Notoxus*); 1825, Fn. Ins. Eur., Fasc. 12: Pl. 4 (in *Agnathus*); Kaszab, 1969, in Freude, Harde, & Lohse, Die Käf. Mitteleur. 8:215. **Europe.**

Zusammenfassung

Frühere Autoren stellten die heteromeren Käfergattungen *Lagrioida* Fairm. et Germ., *Cononotus* LeConte und *Agnathus* Germar zu den Pythidae, Salpingidae, Lagriidae, Melandryidae und Cononotidae und interpretierten ihre Ähnlichkeiten mit den Anthicidae mehr als Resultat konvergenter Entwicklung als das phylogenetischer Verwandtschaft, was der Autor als falsch erkannt hat. Sie sind zweifellos Anthiciden und Cononotidae Crowson 1953 ist ein jüngeres Synonym für Anthicidae Latreille 1825 (**syn.n.**). Bei den *Lagrioida* (wie auch den anderen beiden Gattungen) sind die Metacoxae weit voneinander getrennt (wie bei den Anthicinae) und sie unterscheiden sich in diesem Merkmal wie auch durch die (abweichend von den anderen Unterfamilien) verwachsenen ersten beiden sichtbaren Abdominalsternite von allen Eurygeniinae. Sie werden deshalb aus den Eurygeniinae herausgenommen und in eine **neue Unterfamilie** Lagrioidinae Abdullah gestellt—eine abgeleitete Gruppe, die mehr oder weniger zwischen den Eurygeniinae und Anthicinae steht. Zusammen mit den bekannten ursprünglichen und abgeleiteten Merkmalen wird ein Schlüssel zu den Unterfamilien der Anthicidae der Welt, den Tribus (Lagrioidini, Agnathini und Cononotini), Gattungen und Arten der Lagrioidinae vorgelegt. Auch ein Katalog der Lagrioidinae (Anthicidae) wird aufgestellt. Abschliessend drängt der Autor darauf, dass die von einigen Autoritäten vorgeschlagenen Einschränkungen oder Verbote in der Beschreibung neuer Arten auch auf die Beschreibung neuer Familien bei Käfern und anderen Gruppen ausgedehnt werden sollte.

REFERENCES

- ABDULLAH, M. 1964. New heteromorous beetles (Coleoptera) from the Baltic amber of eastern Prussia and gum copal of Zanzibar. Trans. R. Ent. Soc. London 116(3):329-346; 2 pl.
- ABDULLAH, M. 1969. Conspectus of the current classification of Coleoptera with synonymies. Beitr. Ent. 19(3/6):683-685.
- ABDULLAH, M. 1969. The natural classification of the family Anthicidae (Coleoptera) with some ecological and ethological observations. Deutsche Ent. Ztschr. 16(IV/V):323-366; 3 pl.
- ABDULLAH, M. 1971. On the primitive and derivative characters of the families of beetles (Coleoptera). Beitr. Ent. 21(3/6):503-506.
- ABDULLAH, M. 1972. The improvement of an existing modern classification in biology. Zool. Beitr. 18:in press.
- ABDULLAH, M. (in press) The higher classification of the insect order Coleoptera including fossil records and a classified directory of the coleopterists and Coleoptera collections of the world.
- ABDULLAH, M. (in press) The systematic position of Cisidae (Heteromera) including comments on this and other central European families of Cucujoidea (Coleoptera). Ms.
- ABDULLAH, M., & A. ABDULLAH. 1966. Byturidae and Biphyllidae (Coleoptera), two primitive families of the Heteromera not the Clavicornia—a new interpretation of some old observations. Ent. News LXXVII (3):63-69.
- ABDULLAH, M., & A. ABDULLAH. 1968. The taxonomic position of *Lagrioida* with a proposed new tribe of the Eurygeniinae (Col., Anthicidae). Entomologist's mon. Mag. 104:73-74.
- ARNETT, R. H. JR. 1968. The beetles of the United States. Amer. Ent. Inst., Ann Arbor. xii + 1112 p.
- CHAMPION, G. C. 1890. On the true affinities of the heteromorous genus *Lagrioida* Fairmaire and Germain. Entomologist's Mon. Mag. 26:121-122.
- CROWSON, R. A. 1953. The classification of the families of British Coleoptera. Ent. Mon. Mag. 89:37-59.
- CROWSON, R. A. 1967. The natural classification of the families of Coleoptera. Classey Ltd., Middlesex, England. 187 p.
- CROWSON, R. A. 1969. Review. Syst. Zool. 18(4):450-454.
- CROWSON, R. A. 1970. Classification and biology. Heinemann Ed. Books Ltd., London. 350 p.
- HATCH, M. H. 1965. Family Pythidae. In The beetles of the Pacific Northwest IV. University of Washington Press, Seattle. p. 84-88.
- HEBERER, G. 1954-1959. ed. Die Evolution der Organismen, G. Fischer, Stuttgart.
- JARVIK, E. 1955. The oldest tetrapods and their forerunners. Sci. Monthly 80:141-154.
- KASZAB, Z. 1969. In Freude, H., K. W. Harde, & G. A. Lohse (eds.). Die Käfer Mitteleuropas, Band 8. Goecke & Evers, Krefeld. 388 p.
- LECONTE, J. L. 1862. Classification of Coleoptera of North America I. Smithsonian Misc. Colln., Washington. 178 p.
- MANDL, K. 1971. Wiederherstellung des Familienstatus der Cicindelidae (Coleoptera). Beitr. Ent. 21:507-508.
- MAYR, E. 1963. Animal species and evolution. Harvard Univ. Press, Cambridge, Mass. xiv + 797 p.
- OLDROYD, H. 1966. The future of taxonomic entomology. Syst. Zool. 15(4):253-260.
- VAN-DYKE, E. C. 1939. New species and subspecies of west American Coleoptera. Pan-Pacific Ent. 15:15-20.